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G. H. STEPHENS

2,260,412

KEY ACTION FOR MUSICAL INSTRUMENTS

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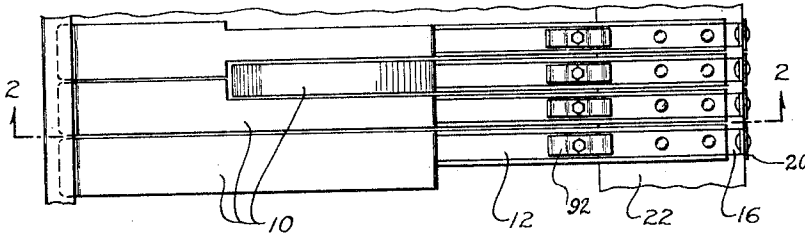


Fig. 1

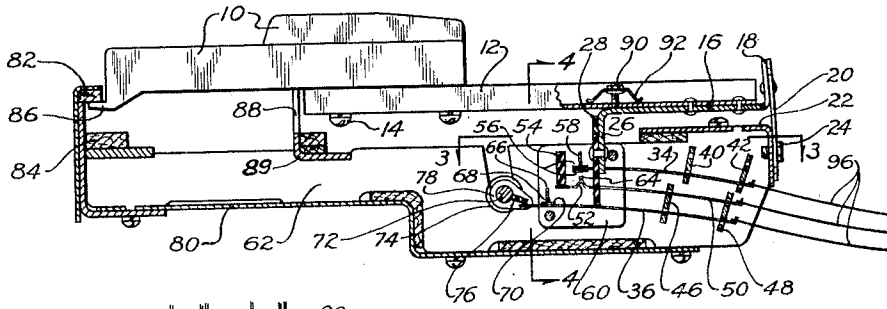


Fig. 2

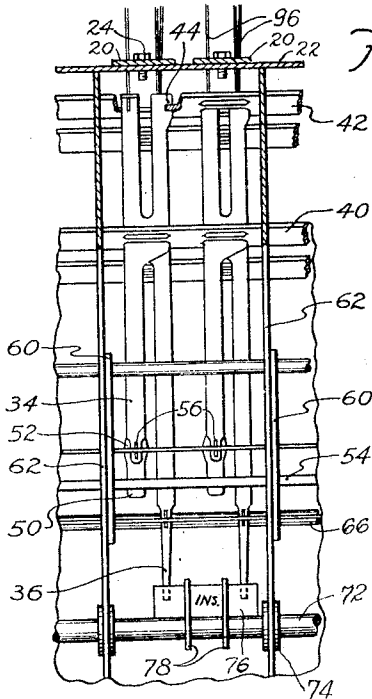


Fig. 3

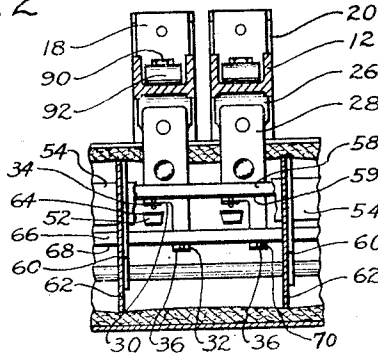


Fig. 4

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UNITED STATES PATENT OFFICE

2,260,412

KEY ACTION FOR MUSICAL INSTRUMENTS

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8 Claims. (Cl. 84-423)

My invention relates generally to musical instruments and more particularly to improved key actions therefor.

It is an object of my invention to provide an improved key action for musical instruments, particularly electrical musical instruments in which switches are operated by depression of the keys.

A further object of my invention is to provide an improved key action which is simple in construction and design, may be readily adjusted, and which may be economically manufactured.

Other objects will appear from the following description, reference being had to the accompanying drawing in which:

Figure 1 is a plan view of a fragmentary portion of a complete keyboard;

Figure 2 is a vertical section of the view thereof taken on the line 2-2 of Figure 1;

Figure 3 is an enlarged plan view of the switch portion of the keyboard taken on the line 3-3 of Figure 2; and,

Figure 4 is an enlarged vertical sectional view taken on the line 4-4 of Figure 2.

The keyboard of the invention is adapted for use in electrical musical instruments of the type shown in the patent to Laurens Hammond No. 2,126,464, and comprises a plurality of keys 10 which are preferably of a molded plastic composition of the form shown in Hammond Patent No. 2,117,002, each key being secured to a key bar 12 by a pair of cap screws 14. The rearward ends of the key bars 12 are riveted, or otherwise suitably secured, to Z-shaped strips 16 made of soft steel or similar material which may readily be deformed.

Each of the strips 16 has an upwardly bent portion 18 which is riveted to a leaf spring 20, the lower end of which may be secured to the downwardly extending leg of an angle 22 by a cap screw 24. The angle 22 may extend the full length of the keyboard of the instrument, and is mounted so as to be a rigid part of the structure thereof.

The forward downwardly bent end 26 of the strip 16 has switch actuator 28 of insulating material riveted or otherwise suitably secured thereto, the actuator having end faces 30 and 32 for engagement with flexible switch fingers 34 and 36 respectively. The switch finger 34, which may be made of suitable resilient flexible material such as phosphor bronze, is supported in a pair of insulating strips 40 and 42 which are perforated with slots to receive the switch finger. The rearward ends of the switch finger are provided

with a notch 44 (Fig. 3), which latchingly interlocks with the strip 42 in a manner more fully disclosed in the patent to Hammond No. 2,099,204. The switch finger 36 is similarly supported by perforated insulating strips 46, 48.

An intermediate switch finger 50 is likewise supported above the switch finger 36 in perforations formed in the insulating strips 46 and 48, the forward end of the switch finger 50 having an upwardly extending inverted V-shaped bend 52 formed therein, and its forward extremity normally engaging an insulating strip 54, limiting upward movement of the forward end of the finger 50. It will be apparent from Figure 2 that the insulating strips 40, 42, 46 and 48 are positioned at such an angle that the normally straight switch fingers 34, 36 and 50 have their forward ends flexed downwardly.

The switch finger 34 has a pair of contact wires 56 welded or otherwise secured to its forward extremity, the upper contact wire 56 normally engaging a contact wire 58 welded to the lower edge of a bus bar 58, which is suitably supported in insulating plates 60 which are suitably secured to the frame plates 62.

The bus bar 58 may extend the full length of the keyboard, or may be made in several sections. The lower contact wire 56 on the switch finger 34 is adapted, upon operation of the key, to contact with a contact wire 64 which is welded or otherwise secured to the apex of the inverted V portion of the switch finger 50.

A bus bar 66 carried in the insulating plates 60 has a longitudinally extending contact wire 68 along its lower edge for engagement with a contact wire 70, which is welded or otherwise secured to the switch finger 36. Wires 68 and 70 are normally in contact but are separated either upon depression of the key, or upon clockwise rotation of a sustaining pedal operated shaft 72 which is mounted in bearings 74, and has an insulating strip 76 secured thereto by arms 78 which are staked to the shaft 72.

The frame plates 62 are suitably supported in spaced relation by having lugs thereof projecting into complementary slots formed in the angle 22 and in the bottom closure plate 80.

The upward and downward movement of the white keys 10 is limited by felt strips 82 and 84, which are suitably supported for engagement with forward projections 86 of the keys. The lateral spacing of the forward ends of the keys is determined by guides 88, which are preferably integral with an angle 89 to form a comb-like structure. The guides 88 insure that the keys

pivot in vertical planes. The guides are constructed and function in a manner more fully disclosed in the aforesaid Patent No. 2,117,002, those associated with the black keys having means to limit the upward movement of the keys.

The position of the downwardly extending portion of the strip 16 with respect to the key bar may be adjusted by means of a set screw 90 which is threaded in the key bar 12 and has its end engaging the forward end of the strip 16, the set screw being held in adjusted position by a spring lock washer 92.

During the assembly of the keyboard, after the key bar has been attached to the angle 22 by the cap screw 24, the resilient resistance to depression of the key may readily be adjusted by bending the upwardly bent portion 18 of the strip 16, using a pair of pliers or other suitable tool. In this way, the leaf spring 20 is placed under more or less initial tension, and the "touch" of the key may thereby be adjusted to meet the requirements of a key which may be easily pressed and will be responsive to rapid strokes of the finger. The normal position of the actuator 28 with respect to the switch fingers 34 and 36 is adjusted by means of the screw 90, the screw being operable to bend the forward end of the strip 16 to the position desired.

Connecting wires 96 are welded or otherwise secured to the switch fingers 34, 36 and 50. The bus bars 58 and 66 are preferably supported for a sliding movement in the insulating sheet 60 so that they may be moved longitudinally to bring different portions of their contact wires into registry with the contact wires of the cooperating switch fingers, and thus effectively move the contact surfaces. This may be accomplished in a manner similar to that disclosed in the aforesaid Patent No. 2,099,204. For this reason, the contact wires on the bus bars are preferably made of slightly softer metal than their cooperating contacts, so that mechanical wear will take place mainly on the bus bar contact wire, the contact portions of which may effectively be renewed by shifting the bus bars longitudinally. The contact wires are preferably made of suitable platinum, iridium or palladium alloys.

The pivotal mounting of the keys disclosed herein has a number of pronounced advantages which are derived from using a flat, relatively wide, short spring which extends at an angle to the shank of the key. The spring functions as a simple key return spring, but in addition serves as a means to prevent tilting of the key about its longitudinal axis, or axes parallel thereto, because the spring is very rigid with respect to resisting forces which would tend thus to tilt the key; and such tilting is resisted without possibility of noise because there is no back-lash in the system, i. e., all parts are rigidly secured together. Furthermore, the springs permit slight lateral swinging movement of the keys, thus making it possible accurately to space the keys by means of the guides 88, without any tendency toward excessive friction or binding action between the guides and the keys. This is an important factor in the manufacture of the keyboard, because during assembly thereof no individual adjustments are required to obtain accurate spacing and alignment of the keys. The spring forms a combined pivot and key return means which may be produced at a low cost, which is free from the possibility of squeaking or making other noises, and which does not require lubrication or felt pads to eliminate noise.

While I have shown a preferred form of my invention, it will be apparent to those skilled in the art that numerous variations and modifications may be made without departing from the underlying principles of the invention. I therefore desire, by the following claims, to include within the scope of my invention, all such similar constructions whereby substantially the results of my invention may be obtained by substantially the same means.

I claim:

1. In a piano type keyboard having a plurality of playing keys, the combination of a bar secured to each of said keys, a fixed support, and means individual to each of said key bars and keys for supporting the latter for pivotal movement relative to said fixed support, said means comprising a leaf spring extending at substantially a right angle with respect to the axis of said key bar and having its ends secured to said key bar and to said support respectively.

2. In a piano type keyboard having a plurality of depressible playing keys, the combination of a bar secured to each of said keys, a fixed support, and means individual to each of said key bars and keys for supporting the latter for pivotal movement relative to said fixed support, said means comprising a key return leaf spring extending at substantially a right angle with respect to the axis of said key bar, a relatively rigid element of sufficiently ductile metal to be readily deformed manually by the use of a hand tool, means for securing one end of said spring to said element, and means for securing the assembly of said element and said spring to said key bar and said fixed support to form a resilient and deformable connection between said key bar and said support, whereby deformation of said element will change the effectiveness of said spring to return said key from depressed position to normal position.

3. In a piano type keyboard having a plurality of depressible playing keys, the combination of a horizontally extending bar secured to each of said keys, a fixed support, and means individual to each of said key bars and keys for supporting the latter for pivotal movement relative to said fixed support, said means comprising an element of sufficient ductility that it may be bent by the use of a hand tool and will retain its deformed shape in normal use, said element having a portion secured its associated key bar and a portion extending substantially vertically with respect thereto, and a leaf spring positioned in a generally vertical plane and having one end secured to said vertically extending portion of said element and its other end secured to said fixed support, whereby the effective tension of said leaf spring may be adjusted by bending said element, and said leaf spring will forcefully resist tilting of said key bar about its longitudinal axis.

4. In a piano type keyboard, the combination of a flexible switch finger, a pivotally mounted key bar for flexing said switch finger, an insulating actuator engageable with said switch finger, and a deformable element forming a rigid connection between said key bar and said actuator, said deformable element being made of a sufficiently ductile metal that it may readily be deformed by the use of hand tools but will be of sufficient rigidity to retain its deformed shape under all normal conditions of use, whereby the position of said actuator with respect to said key bar may be adjusted to compensate for unavoidable ir-

regularities in the relative locations of said key bar and switch finger.

5. The combination set forth in claim 4 in which said deformable element has a portion thereof rigidly secured to said key bar, and in which an adjusting screw threaded in said key bar engages said element at a point intermediate the portions of said element which are secured to said key bar and to said actuator respectively, whereby rotation of said screw in one direction will cause deformation of said element in a manner to change the position of said actuator with respect to said key bar.

6. In a piano type keyboard, the combination of a stationary support, a spring having one end secured to said support, a key bar, a deformable rigid metal strip secured to said key bar and having a deformable portion thereof secured to said spring, a switch member, an actuator for said switch member, a deformable part for securing said actuator to said key bar, said strip and said deformable part being made of sufficiently ductile metal that they may be deformed by the use of hand tools and maintain their deformed shape under all conditions of normal use, an adjustable means for deforming said deformable part, whereby the effective tension of said

spring may be varied by deforming said metal strip, and the position of said actuator with respect to said key bar may be varied to compensate for unavoidable irregularities in the relative positions of said key bar and switch member.

7. The combination set forth in claim 6 in which said deformable part is integral with said metal strip, and said metal strip is secured to said key bar at a point intermediate the deformable portion thereof and the deformable part thereof.

8. In a piano type keyboard, the combination of a key having a shank, a fixed rigid support, and a short leaf spring having its ends secured respectively to said shank and to said support, said spring being located in a plane substantially perpendicular to the axis of the shank across the end of said shank and forming a pivotal resilient support for said key which, due to the angular relation between the plane of the spring and the longitudinal axis of the shank, causes the spring to be effective substantially as a rigid element resisting tilting of the shank about its longitudinal axis.

GEORGE H. STEPHENS.

CERTIFICATE OF CORRECTION.

Patent No. 2,260,412.

October 28, 1941.

GEORGE H. STEPHENS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 26, claim 2, strike out the words "means individual to each of said key bars and"; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 13th day of January, A. D. 1942.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.

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